

What is claimed is:

1. A membrane valve comprising:

a valve seat having a continuous surface and one or two openings;

a shutter disk of flexible material surrounding said openings and having a peripheral sealing lip;

an optional annular wall extending from said valve seat and surrounding said openings, said optional annular wall creating one or more depressions around said openings, said optional annular wall being in sealing contact with said peripheral sealing lip when a gas or a liquid is not being ejected through said openings;

first means for clamping said shutter disk to said valve seat, said first means extending from said shutter disk and being engaged with each of said openings on said valve seat; and

second means for retaining one portion of said shutter disk substantially in contact with said valve seat during ejection of liquid or gas through said valve, said portion of said shutter disk being situated along a line that is secant to said shutter disk.

2. A membrane valve as in claim 1, wherein the shutter disk comprises peripheral extension lobes.

3. A membrane valve as in claim 1, wherein the second means retain a first portion of the shutter disk substantially in contact with the valve seat along part of a line that is secant to said shutter disk and retain also a second portion of said shutter disk substantially in contact with said valve seat along parts of two different lines that are secant to said shutter disk.

4. A membrane valve as in claim 1, wherein the second means retain a portion of the shutter disk substantially in contact with the valve seat along a line that is a diametrical axis of said shutter disk.

5. A membrane valve as in claim 1, wherein the second means retain a portion of the shutter disk substantially in contact with the valve seat along a line that is not coincident with a diametrical axis of said shutter disk.

6. A membrane valve as in claim 1, wherein the second means are in discontinuous contact with the line that is secant to the shutter disk.

7. A membrane valve as in claim 1, wherein the first means consist essentially of one or two primary clamping pins, said primary clamping pins being equal in number to the openings on the valve seat.

8. A membrane valve as in claim 1, wherein the second means are a stop rib, said stop rib being substantially in contact with the shutter disk but not pressing against said shutter disk.

9. A membrane valve as in claim 8, wherein the stop rib has a peripheral edge substantially in contact with the shutter disk and wherein said peripheral edge is square, tapered, beveled or rounded.

10. A membrane valve as in claim 8, wherein the stop rib has a peripheral edge substantially in contact with the shutter disk and wherein said peripheral edge is continuous, discontinuous, toothed or comb-shaped.

11. A membrane valve as in claim 8, wherein the stop rib is blade-shaped, and wherein said stop rib includes two protruding extensions along opposite sides of the peripheral edge of said stop rib.

12. A membrane valve as in claim 11, wherein the two protruding extensions taper outwards and then inwards from the stop rib, said protruding extensions first flaring out of said stop rib and eventually converging again into said stop rib.

13. A membrane valve as in claim 12, wherein the first means consist essentially of one primary clamping pin extending from the shutter disk and engaged in the opening on the valve seat, and wherein the two protruding extensions essentially cover that area of said shutter disk which corresponds to said primary clamping pin.

14. A membrane valve as in claim 7, wherein the second means consist essentially of a row of secondary clamping pins, said secondary clamping pins extending from the shutter disk and said secondary clamping pins being engaged in corresponding openings on the valve seat.

15. A membrane valve as in claim 14, wherein:
the first means consist essentially of one primary clamping pin extending from the shutter disk and engaged in the opening on the valve seat;
the row of secondary clamping pins includes said primary clamping pin;

a depression surrounds said opening, said depression being completely covered by said shutter disk;

valve ribs extend radially from said opening to the edge of said depression, said valve ribs joining in a hub that encircles said opening; and

said row of secondary clamping pins is positioned on two of said valve ribs, said two valve ribs being situated in opposite positions in relation to said opening.

16. A membrane valve as in claim 14, wherein the first means consist essentially of a primary clamping pin extending from the shutter disk, and wherein the row of secondary clamping pins does not include said primary clamping pin.

17. A membrane valve comprising:

a valve seat having a continuous surface and one or two openings;

a shutter disk of flexible material surrounding said openings and having a peripheral sealing lip;

an optional annular wall extending from said valve seat and surrounding said openings, said optional annular wall creating one or more depressions around said openings, said optional annular wall being in sealing contact with said peripheral sealing lip when a gas or a liquid is not being ejected through said openings;

first means for clamping said shutter disk to said valve seat, said first means extending from said shutter disk and being engaged with each of said openings on said valve seat; and

second means for retaining two portions of said shutter disk substantially in contact with said valve seat during ejection of liquid or gas through said valve, said portion of said shutter disk being situated along two lines that are secant to said shutter disk.

18. A membrane disk as in claim 17, wherein the two lines are parallel to each other for at least part of all of their length.

19. A membrane valve as in claim 17, wherein the two lines are positioned symmetrically with reference to a diametrical axis of the shutter disk.

20. A membrane valve as in claim 17, wherein the two lines are parallel but positioned asymmetrically with reference to a diametrical axis of the shutter disk.

21. A membrane valve as in claim 17, wherein the second means consist essentially of two stop ribs, said stop ribs being spaced from each other and said stop ribs being substantially in contact with the shutter disk.

22. A membrane valve as in claim 21, wherein the first means consist essentially of a primary clamping pin extending from the shutter disk and engaged in the opening on the valve seat, and wherein the two stop ribs are positioned symmetrically in relation to said primary clamping pin.

23. A membrane valve as in claim 21, wherein the first means consist essentially of a primary clamping pin extending from the shutter disk and engaged in the opening on the valve seat, and wherein the two stop ribs are positioned on asymmetrically opposite sides in relation to said primary clamping pin.

24. A membrane valve as in claim 21, wherein the first means consist essentially of a primary clamping pin extending from the shutter disk and engaged in the opening on the valve seat, and wherein the two stop ribs are positioned on the same side in relation to said primary clamping pin.

25. A membrane valve as in claim 21, wherein the first means consist essentially of two primary clamping pins extending from the shutter disk and engaged in two corresponding openings on the valve seat, and wherein the two stop ribs are not parallel to the line connecting said primary clamping pins.

26. A membrane valve as in claim 25, wherein the two stop ribs are positioned symmetrically in relation to the two primary clamping pins.

27. A membrane valve as in claim 25, wherein the two stop ribs are positioned asymmetrically in relation to the two primary clamping pins.

28. A membrane valve as in claim 21, wherein the first means consist essentially of two primary clamping pins extending from the shutter disk and engaged in two corresponding openings on the valve seat, and wherein the two stop ribs are positioned along lines intersecting the longitudinal axes of said primary clamping pins.

29. A membrane valve as in claim 21, wherein the first means consist essentially of two primary clamping pins extending from the shutter disk and engaged in two corresponding openings on the valve seat, and wherein the two stop ribs are positioned on lines parallel to the line connecting said primary clamping pins.

30. A membrane valve as in claim 21, wherein the two stop ribs have peripheral edges that are substantially in contact with the shutter disk and wherein said peripheral edges are tapered with rounded ends.

31. A membrane valve as in claim 21, wherein the stop ribs have peripheral edges that are substantially in contact with the shutter disk in a discontinuous fashion.

32. A membrane valve as in claim 21, wherein the two stop ribs consist each of two or more rod-shaped members.

33. A membrane valve as in claim 17, wherein the first means consist essentially of a primary clamping pin extending from the shutter disk and engaged in the opening on the valve seat, and wherein the second means consist two rows of secondary clamping pins situated along parallel lines, said secondary clamping pins being engaged in corresponding openings on the valve seat.

34. A membrane valve as in claim 17, wherein the first means consist essentially of two primary clamping pins engaged in two matching openings on the valve seat, and wherein the second means consist two rows of secondary clamping pins, each one of said rows of secondary clamping pins including one of said clamping pins.

35. A membrane valve as in claim 17, wherein the first means consist essentially of two primary clamping pins engaged in two matching openings on the valve seat, and wherein the second means along each one of the lines consist both of a stop rib and of a row of secondary clamping pins.

36. A membrane valve as in claim 17, wherein the first means consist essentially of two primary clamping pins engaged in two matching openings on the valve seat, and wherein the second means along each one of the lines consist essentially of a stop rib or of a row of secondary clamping pins.

37. A membrane valve as in claim 17, wherein the shutter disk is not of circular shape, and wherein the second means are positioned along lines that do not include the longest diameter of said shutter disk.

38. A membrane valve as in claim 17, wherein the shutter disk is not of circular shape, and wherein the second means are positioned along lines that are parallel to the shortest diameter of said shutter disk.

39. A second stage pressure reducer for two-stage pressure regulators, comprising:

- a chamber for storing and delivering breathing gas, said chamber being contained within a case;

- an outlet connecting said chamber to a mouthpiece;

- an inlet connecting said chamber to a first stage pressure reducer, said first stage pressure reducer being further connected to a high pressure gas source;

- a spring valve housed within said chamber, said spring valve regulating the inflow of said breathing gas into said chamber from said first stage pressure reducer, said spring valve opening when pressure within said chamber fall below a predetermined level and being closed otherwise;

- a membrane valve regulating the outflow of spent gas, said membrane valve being housed in said case, said membrane valve comprising: a valve seat having a continuous surface and at least one opening; a shutter disk of flexible material surrounding said opening and having a peripheral sealing lip; an optional annular wall extending from said valve seat and surrounding said opening, said optional annular wall creating one or more depressions around said opening, said optional annular wall being in sealing contact with said peripheral sealing lip when a gas is not being ejected through said opening; first means for clamping said shutter disk to said valve seat, said first means extending from said shutter disk and being engaged with said opening on said valve seat; and second means for retaining at least one portion of said shutter disk substantially in contact with said valve seat during ejection of gas through said valve, said portion of said shutter disk being situated along a line that is secant to said shutter disk.

40. A second stage pressure reducer as in claim 39, wherein the shutter disk of the membrane valve is surrounded by an outflow duct, one wall of said outflow duct consisting of a portion of the outer wall of the case and the remaining walls of said outflow duct consisting of a profiled member, said outflow duct having open ends to allow for the escape of the gas ejected through said membrane valve; and wherein the second means comprise a stop rib extending from said central section to come substantially in contact with said shutter disk.

41. A second stage pressure reducer as in claim 40, wherein the shutter disk of the membrane valve is surrounded by an outflow duct, one wall of said outflow duct consisting of a portion of the outer wall of the case and the remaining walls of said outflow duct consisting of a profiled member having different sections, said sections including a central section that can be opened to provide access to said membrane valve, said sections further including head sections, each of said head sections having open ends to allow for the escape of the gas ejected through said membrane valve; and wherein the second means comprise a stop rib extending from said central section to come substantially in contact with said shutter disk.

42. A second stage pressure reducer as in claim 41, wherein the first means consist essentially of a clamping pin extending from the shutter disk and engaged in the opening on the valve seat, and wherein the stop rib comes substantially in contact with that portion of the shutter disk that includes said clamping pin.

43. A second stage pressure reducer as in claim 41, wherein the stop rib extends from the central portion of the outflow duct, and wherein said stop rib comes in contact with the shutter disk without exercising pressure on said shutter disk.

44. A second stage pressure reducer as in claim 41, wherein the membrane valve is positioned on the case in a position that is opposite, in relation to the mouthpiece, to the chamber for storing and delivering breathing gas, and wherein the outflow duct has a longitudinal axis that is essentially perpendicular to the longitudinal axis of the mouthpiece, said outflow duct further having open head sections that are oriented at angles of no less than 90 degrees from the longitudinal axis of said mouthpiece.

45. A second stage pressure reducer as in claim 41, wherein the membrane valve is housed within a flattening of the case wall, said flattening being contained within a plane that is inclined in relation to the longitudinal axis of the mouthpiece.

46. A second stage pressure reducer as in claim 41, wherein the shutter disk has an elongated shape, said elongated shape having the longest diameter oriented in a direction that is parallel to the longitudinal axis of the outflow duct.

47. A second stage pressure reducer as in claim 46, wherein:

the shutter disk is of a form that is elliptical, substantially elliptical or elongated with rounded minor edges;

the first means consists of a clamping pin extending from the shutter disk and engaged in the opening on the valve seat;

the major axis of said shutter disk is parallel to the longitudinal axis of the outflow duct; and

the stop rib is substantially in contact with said shutter disk along the minor axis of said shutter disk.

48. A second stage pressure reducer as in claim 39, wherein:

the shutter disk of the membrane valve is surrounded by an outflow duct, one wall of said outflow duct consisting of a portion of the outer wall of the case and the remaining walls of said outflow duct consisting of a profiled member having different sections, said sections including a central section that can be opened to provide access to said membrane valve and further including head sections, each of said head sections having open ends to allow for the escape of the breathed gas;

said shutter disk is of elongated shape;

the first means consist essentially of two clamping pin extending from the shutter disk and engaged in matching openings on the valve seat;

the major axis of said shutter disk is oriented parallel to the longitudinal axis of said outflow duct; and

the second means comprise two stop rib extending from said central section to come substantially in contact with said shutter disk.